Thomas C Jackson. The Design, Implementation, and Evaluation of the Multimedia Story Builder and Multimedia Story Player Content Management and Delivery Systems. A Master's Paper for the M.S. in I.S degree. November, 2006. 76 pages. Advisor: Deborah Barreau

This paper documents the planning, design, implementation, and preliminary evaluation of the Multimedia Story Builder and Multimedia Story Player – two applications that together are used to create, edit, manage, and deliver web-based multimedia presentations. These applications incorporate simple and intuitive interfaces, extensive functionality, multiple presentation methods, and support for multiple media types, all of which represent improvements over similar systems. The results of a preliminary usability test and suggestions for future testing and development are also described.

Headings:

Web Interface Design

User Interface Design

Multimedia Presentation and Delivery

Multimedia Content Management

Human-Computer Interaction

THE DESIGN, IMPLEMENTATION, AND EVALUATION OF THE MULTIMEDIA STORY BUILDER AND MULTIMEDIA STORY PLAYER CONTENT MANAGEMENT AND DELIVERY SYSTEMS

by
Thomas C. Jackson

A Master's paper submitted to the faculty
of the School of Information and Library Science
of the University of North Carolina at Chapel Hill
in partial fulfillment of the requirements
for the degree of Master of Science in
Information Science.

Chapel Hill, North Carolina

November 2006

Approved by

_____

Deborah Barreau

Table of Contents

Table of Figures

Overview of the Project

The goal of this project is to create an intuitive application that facilitates the creation of web-deliverable multimedia (photo, audio, video, and textual) presentations and the management of their assets, in order to increase the efficiency with which such presentations can be made and expand the potential user group that encompasses their creators.

Introduction

The Multimedia Story Builder (MMSB) and Multimedia Story Player (MMSP) represent an attempt to improve upon existing multimedia presentation applications (MPAs) and the way in which users interact with and manipulate digital media files in general. Within the scope of this project, an MPA is defined as any application that provides functionality for the creation, manipulation, and/or presentation of multimedia files. The MMSB incorporates several unique design decisions (detailed in the *Design Decisions* section of this paper) in an attempt to expand the potential user groups accommodated by most existing MPAs and to increase the productivity of the users of these applications. Specifically, the MMSB and MMSP together, comprise a start-to-finish application that facilitates the creation, management, and delivery of web-based multimedia presentations. A multimedia presentation or story, as defined within the scope of this project, is a sequential, synchronized composition or a freely navigable gallery of audio, photo, video, flash, and/or text media.

A multimedia presentation that is created as a sequential composition may contain any number and/or combination of media elements and is viewed much like a movie. A sequential presentation displays a set of multimedia elements, one after another, over specific period of time and in a specific order. Media files contained in this type of presentation are organized with specific temporal relations to each other, which remain constant throughout the playback of the presentation. Sequential presentations are

controlled via the Multimedia Story Player, which functions in a manner similar to a standard movie player such as a QuickTime player or Windows Media player.

A multimedia presentation that is created as a media gallery also may contain any number and/or combination of media elements, but functions more as a browser such as that found in a typical online photo gallery. This type of presentation is comprised of a set of multimedia elements, which may be viewed in any order and which are not bound by individual timings or a defined presentation time. In order to accommodate these criteria, a gallery-based presentation utilizes the Multimedia Story Player to display a navigable list of media to the user, which may include thumbnails or icons representing each asset. This gallery provides the MMSP's users with the ability to freely select and view these media assets.

The MMSB allows a user or group of users with little or no multimedia editing experience to create either type of multimedia presentation with little more than a collection of media files to start with. When combined with the functionality of the MMSP, the application as a whole comprises a complete multimedia content management and delivery system.

Background and Application Justification

The inspiration for this project originated from a multimedia documentary storytelling class offered by the UNC-CH School of Journalism and Mass Communication. The objective of this class is to tell stories about people from unique places and cultures around the world using web-delivered multimedia presentations. Creating and managing these multimedia stories is a problem that both students and instructors face every year in this class. The recurring nature of this problem is the result of several factors: 1) existing MPAs offer limited functionality, can only accommodate a limited set of media types, and/or are difficult to use effectively, 2) the production process and file management that are required for each presentation are independent of the application used to create the presentation, resulting in a disconnected and inconsistent workflow between users, 3) the majority of students enrolled in the class have a very specialized area of expertise, which does not encompass the knowledge necessary to effectively use many of the existing MPAs, 4) the multimedia presentations created by existing MPAs exhibit limited functionality, flexibility, and accessibility and as such, are unable to accommodate the diversity of multimedia presentations created in the class. The MMSB is an attempt to address these problems, which are applicable well beyond the scope of this documentary storytelling class to many existing MPA users in a multitude of production environments.

Functional Limitations of Existing MPAs

Currently, there are many existing MPAs and single-medium presentation applications (SMPAs) available for free or for purchase (Appendix A). Because of the limited types of media they can accommodate, however, SMPAs are inherently inadequate for the creation of multimedia presentations. Common examples of such applications include audio players, such as WinAmp and Sonique, audio editing applications, such as Acid Pro and Audacity, and photo slideshow applications, such as Able Photo Slide Show and Slide Show Pilot. All of these applications are inherently limited in that they can only manipulate and control a single type of medium (static visual, motion-visual, or aural). Additionally, any sort of interoperability between these applications may or may not be possible, limiting the potential for combining their functionality. These limitations of SMPAs make them an unacceptable solution for creating, managing, and/or controlling multimedia presentations, either by themselves or in conjunction with other SMPAs.

There are, however, many MPAs that do not exhibit the single-medium limitations of an SMPA. One such example is Sound Slides. Sound Slides is an application that allows its users to synthesize audio and photo files into Flash-based sequential multimedia presentations. Sound Slides exhibits a very simple and intuitive user interface (Figure 1), which offers visual editing of temporal photo data, a presentation preview screen, and the ability to reorder pictures via drag and drop. The simplicity and intuitiveness of its operation and interface allows Sound Slides to cater to a user group that is similar to the MMSB's. However, Sound Slides is still limited as a complete and flexible MPA because it accommodates only two media file types (photos and audio – both of which *must* be

used in a presentation) and one presentation format (sequential presentations). Additionally, the extreme simplicity of the Sound Slides interface results in a limited feature set, lacking such functionality as explicit numeric temporal data manipulation (setting a medium's start and end times numerically when editing a presentation) and timeline scaling. Sound Slides also has very limited support for the creation and manipulation of individual medium and multimedia presentation metadata.

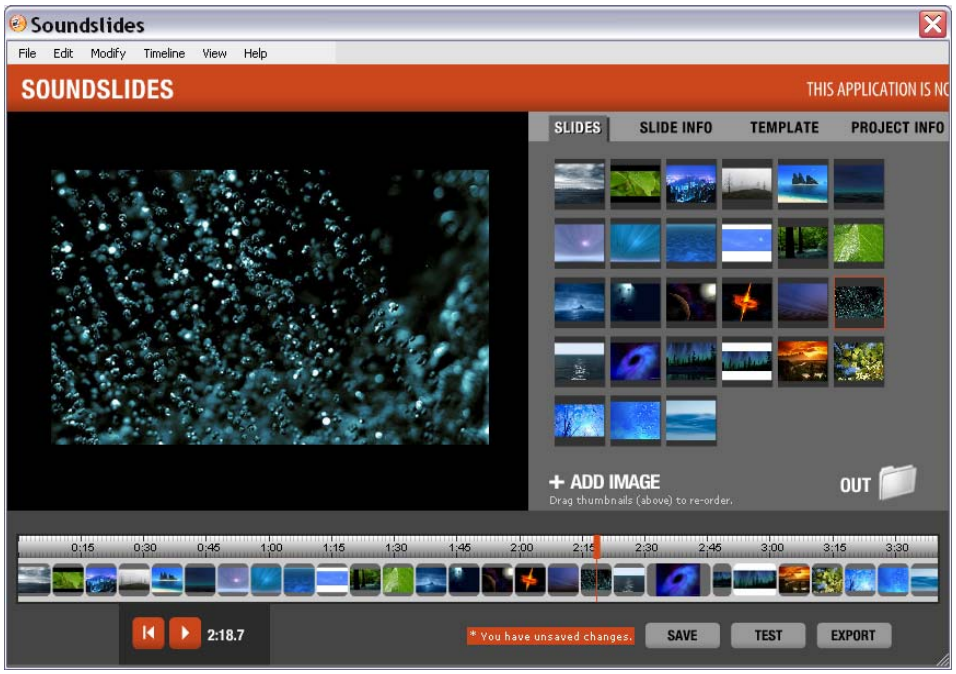


Figure 1. The Sound Slides GUI

Another MPA, which suffers from some of the same drawbacks as Sound Slides, is Slide Show Pro. Slide Show Pro is an application that allows its users to synthesize photo and audio files into Flash-based sequential multimedia presentations and multimedia galleries (as opposed to Sound Slides, which can only create sequential multimedia presentations). Slide Show Pro utilizes a separate application, Slide Show Pro Director (Figure 2), to facilitate the creation of these presentations. Slide Show Pro Director is a

web-based application that uses drag and drop functionality to order a gallery's photos. Like Sound Slides, Slide Show Pro is also limited to manipulating only photo and audio media, hindering its effectiveness as a complete MPA. Additionally, Slide Show Pro offers very little temporal editing capabilities (the sequential presentations display each photo for an equal amount of time), requires two separate applications to effectively create presentations (without Slide Show Pro Director, users must manually edit XML files to create presentations), and is limited to creating asynchronous sequential multimedia presentations (the photos are displayed independently of the audio – they are not synchronized with it).

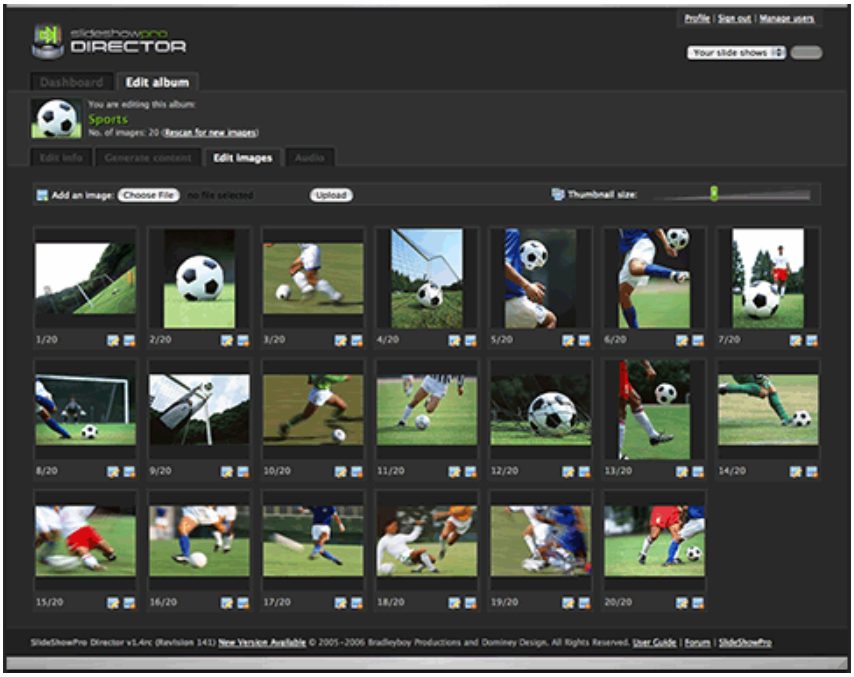


Figure 2. The Slide Show Pro Director GUI

The majority of MPAs examined in this project (Appendix A) exhibit the aforementioned limitation on the number and combination of media that they can accommodate. The most common multimedia combinations utilized by these MPAs

include photo and audio files, video files alone (which include audio and visual information, and thus are considered multimedia), or photo and video files. However, several MPAs accommodate photo, video, audio, and textual media. These applications include Windows Movie Maker (Figure 3), Apple's I-Movie, Final Cut Pro, and Adobe Premiere. The latter two applications, while extremely robust and feature-rich, each exhibit some of the same problems the MMSB is attempting to address: they are both extremely complex and require an extensive knowledge of both the applications themselves and of the process of multimedia editing. These characteristics severely limit the potential user groups of these applications and hinder their general practicality as an MPA. Conversely, Windows Movie Maker and Apple's I-Movie proved to be excellent manifestations of the presentation-building goals of the MMSB. Both of these applications provide their users with intuitive and simple GUIs, the ability to visually examine and edit temporal data, and simple techniques for media file and presentation manipulation. However, even though these applications exemplify most of the presentation-building goals of the MMSB, they also exhibit some of the problems and limitations the MMSB attempts to address (which will be discussed in the following sections).

Figure 3. The Windows Movie Maker GUI

Based on the information gathered during this project, it is clear that many existing MPAs offer limited functionality, accommodate a limited set of media types, and/or exhibit a complex or ineffective GUI. In many cases, these characteristics severely limit the usability and applicability of these MPAs for a broad range of users and thus necessitate the creation of the MMSB.

Separation of Presentation Creation, Content Management, and Project Management in Existing MPAs

In addition to the media and presentation-building limitations exhibited by many of the existing MPAs, many more such applications lack support for project and content management. This absence of functionality fragments the process of creating multimedia presentations, inhibiting the potential for a simple and consistent workflow among one or more users. The general process for creating any multimedia presentation begins with the act of selecting and organizing the media assets to be used in that presentation. As such, it

makes sense for an MPA to include content and project management functionality in order to facilitate this media selection and organization process.

As previously discussed, Slide Show Pro is an example of an MPA that attempts to incorporate this functionality through the use of Slide Show Pro Director. The combination of these two applications does a good job of facilitating the entire process of multimedia presentation creation, including the incorporation of content management. Additionally, because Slide Show Pro Director is web-based, it inherently facilitates consistent content management principles among multiple, distributed users. The disparate nature of the two applications, however, adds a certain degree of separation between defining the content for a presentation and actually creating that presentation. Where Slide Show Pro Director is responsible for selecting media assets and ordering them in a presentation, Slide Show Pro is accessed within the Flash IDE and is responsible for defining all non-content based information about a presentation. Additionally, Slide Show Pro Director does very little to provide communication channels between multiple users or to mitigate the risks of simultaneous use.

Unlike Slide Show Pro, however, most of the MPAs examined in this project did little or nothing to address content and project management. Sound Slides utilizes a computer's local file system to store and select media for inclusion in a presentation. This functionality severely limits the potential for accommodating a distributed user group and provides no consistency among users' organizational methods of media files. This type of content management is also utilized by Windows Movie Maker, Apple's I-Movie, Final Cut Pro, Adobe Premiere, and many more of the MPAs examined in this project, resulting in these applications exhibiting some of the same problems as Sound Slides. In

fact, besides Slide Show Pro and Slide Show Pro Director, no other MPA examined in this project incorporated content management techniques that accommodated multiple, distributed users.

Another option for integrating content and project management functionality into the multimedia presentation building process is to combine an existing MPA with a stand-alone multimedia content management and/or project management system. One example of a multimedia CMS that may be suitable for this role is the Multimedia Digital Library for On-line Search application, or MILOS. Some examples of project management applications that could potentially be combined with an existing MPA include Basecamp, DotProject, and Microsoft Project. The combination of these multimedia CMSs and project management applications with existing MPAs, however, leads to the same problems that Slide Show Pro exhibits: a disconnected workflow for creating multimedia presentations, in which different tasks are accommodated by different applications. Additionally, the functionality provided by existing MPAs, content management systems, and project management systems may or may not be suitable for interaction with other applications in this type of piecemeal solution.

An effective MPA should incorporate the functionality necessary to accommodate content and project management, both of which are essential to the creation of multimedia presentations. Additionally, in its incorporation of this functionality, an effective MPA should facilitate communication and a consistent workflow among its users. The severely limited existence of these functions among existing MPAs further necessitates the creation of the MMSB.

Restricted Usability of Existing MPAs

Most of the existing MPAs examined in this project are designed to address a very specific user group. The scope of these groups is primarily determined by a user's previous experience with multimedia editing and his/her commitment to using and learning the application itself. Final Cut Pro and Adobe Premiere, for example, are designed to accommodate users with a fairly extensive knowledge of multimedia editing who are willing to invest a lot of time and effort in learning how to use an MPA. The primary benefit gained by catering to this user group is the ability to incorporate a broad range of functionality and advanced multimedia editing options, without overwhelming the applications' intended users. Conversely, MPAs such as Sound Slides and Apple's I-Movie are designed to accommodate a more broad and diverse user group, including people with and without multimedia editing experience. These applications do not offer the extensive functionality of Final Cut Pro or Adobe Premiere, but they do provide many of the more commonly used features and multimedia editing capabilities. The MMSB is an attempt to accommodate the broadest user group possible, by providing functionality that is intuitive to the most novel of multimedia editors and by incorporating a selective feature set that still allows for the efficient creation of diverse multimedia presentations. If successful, the MMSB will represent an application that is both simple enough and complex enough to appeal to new and experienced multimedia editors alike.

Limited Flexibility, Accessibility, and Functionality of Multimedia Presentations Created by Existing MPAs

The final characteristic exhibited by many existing MPAs that justifies the development of the MMSB is their inability to produce widely accessible, flexible, and

functionally robust multimedia presentations. The accessibility of these presentations, as defined here, refers to a user's ability to view the presentation without the need to install supplemental software or to change his/her computer settings. According to this guideline, the application of choice for web-delivered multimedia content is Adobe's Flash Player (Figure 4). Several existing MPAs already utilize Flash as a delivery medium, including Sound Slides, Slide Show Pro, EaseFlash Slide Show Generator, and Flash Photo Show. Many MPAs, however, utilize less pervasive multimedia technologies for their presentations, the most common of these being MPEG-4, Windows Media, and QuickTime. Examples of these MPAs include Slide Show To Go (Java), Windows Movie Maker (Windows Media format), ProShow Gold (Photodex Presenter format), and Apple's I-Movie (QuickTime Movie format). These and other applications that utilize presentation technologies other than Flash are inherently less accessible, and therefore less desirable as MPAs.

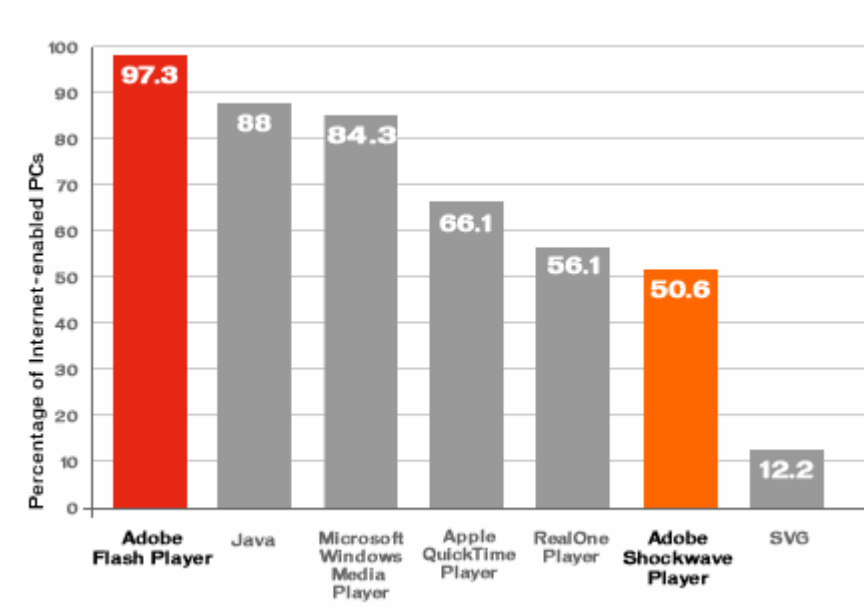


Figure 4. Worldwide ubiquity of web-deliverable multimedia software (from Millward Brown survey, conducted September 2006; accessed at http://www.adobe.com/products/player_census/flashplayer on 14 Oct. 2006)

Another drawback exhibited by many of the multimedia presentations created by existing MPAs is their limited flexibility. The vast majority of MPAs create either sequential or gallery-based presentations, restricting their applicability to specific project types. Both gallery-based and sequential presentations exhibit their own individual advantages for displaying multimedia content in various contexts. Sequential presentations are ideal for multimedia presentations in which each medium contributes to an overarching message or story. These presentations encourage a user to view a presentation in the order and manner its creator wishes it to be viewed. Gallery-based presentations are better suited for displaying multimedia assets that relate to a specific theme or subject-area, but which are not intended to be viewed in any particular order or as part of an overarching message. The differing contexts to which these presentation types apply suggest that an MPA support both presentation methods in order to maximize its flexibility and applicability.

Of the MPAs examined in this project, Slide Show Pro is the only application that allows users to create both sequential and gallery-based presentations. However, as mentioned before, Slide Show Pro supports only photo and audio media and creates only asynchronous sequential presentations (the audio used in these presentations is more like ambient sound in that it is not synchronized with the photos – the audio segment that plays for the third photo in a presentation, for example, can vary depending on how the user has controlled the presentation up to that point). All other MPAs examined in this project were limited to creating either sequential or gallery-based multimedia presentations, limiting their flexibility and project applicability. The pervasive nature of

this limitation among existing MPAs provides further justification for the development of the MMSB and the functionality to support multiple multimedia presentation formats.

Summary: Justification for the Development of the MMSB

Of the numerous existing MPAs examined in this project (Appendix A), all were found to have various limitations that inhibit their usability for a diverse user group and limit their applicability to diverse types of multimedia presentations. These limitations are manifested specifically in several ways: 1) existing MPAs offer limited functionality, can only accommodate a limited set of media types, and/or are difficult to use effectively, 2) the production process and file management that is required for each multimedia presentation is independent of the application used to create the presentation, resulting in a disconnected and inconsistent workflow between the MPA's users, 3) the majority of the potential users of existing MPAs may or may not have the knowledge of multimedia editing necessary to effectively use them, and 4) the multimedia presentations created by existing MPAs exhibit limited functionality, flexibility, and accessibility and as such, are often unable to accommodate the diversity of multimedia presentations attempting to be created by their users. The MMSB attempts to address all these problems, and in doing so, seeks to set a new standard of flexibility, usability, and effectiveness in the creation and management of web-delivered multimedia presentations.

Intended User Group

Definition and Scope

The different functionalities of the MMSB and the MMSP result in a different user group for each part of the application. The MMSB is intended to facilitate the creation of online multimedia presentations, which may be used to convey a broad spectrum of information. As such, the user group for this part of the application is very diverse. This group will include anyone in the U.S. who wishes to manage and present web-accessible multimedia content. The MMSP is the player component of the application and as such, will cater to an even larger user group than the MMSB. Because the MMSP is responsible for playing online multimedia presentations, it must be able to accommodate almost any person with web access. The diversity of the presentations that can be created with the MMSB makes it impossible to further limit the group of people that might be interacting with them via the MMSP. Additionally, the near-ubiquitous nature of the internet allows access to these presentations to people all over the world. (NOTE: The user group studied during the initial testing of this application is more focused and will be described in the *Implementation and Testing* section of this paper).

Psychological Characteristics

The existence of numerous other MPAs allows the end-users of the MMSB to be more selective when deciding which of these applications best suits their needs. This means that MMSB users will most likely have chosen to use it, implying a positive

attitude toward using the application (or at least a preference for using the MMSB over other MPAs). Additionally, the interaction principles of the MMSB's GUI are intended to make file manipulation and multimedia presentation creation simple, intuitive, and enjoyable. These principles should positively affect the psychological state of the MMSB's end-users. Unlike those of the MMSB, the end-users of the MMSP have no choice but to use it in order to view presentations created with the MMSB. The similarity of the MMSP's functionality and graphical interface to those of standard multimedia playback applications, however, implies that users will feel at least as satisfied using the MMSP as they would using these other playback applications. This relationship also implies that MMSP users will not be psychologically reluctant to use it relative to using the other multimedia playback applications.

Knowledge and Experience

The users of the MMSB and MMSP will likely have at least a basic level of knowledge about computers and the internet. Both applications are primarily mouse-controlled, and as such, do not necessitate that a user be a proficient typist. MMSB users must be English-speaking, whereas users of the MMSP may speak any language included in the presentation he/she is controlling (which is left to the discretion of the presentation's creator). Users of the MMSB may or may not have multimedia editing experience or experience working with multimedia file management. Users of the MMSP will likely have experience using multimedia players, such as Windows Media Player or Apple QuickTime Player, and as such, they should be familiar with standard digital media playback controls (play and pause buttons, as well as a play head and scrub track).

Physical Characteristics

Potential users of the MMSB will probably be 15 years of age and older (high school students, college students, and adults), with a fairly even distribution of males and females. Users are assumed to have adequate perceptual abilities and motor skills to use the MMSB and MMSP. The multiple communication methods that are inherent in a multimedia presentation will make the MMSP more accessible to users with visual or aural disabilities. However, the scope of this project will not include users with visual or mobility disabilities in the potential user group of the MMSB or MMSP.

Business Requirements

Prior to developing the MMSB and MMSP, it was necessary to identify a set of business requirements to which the applications would adhere. These requirements specify the general principles and functionality the MMSB and MMSP must implement through their functional specifications. The business requirements for the MMSB and MMSP are the result of several informal interviews with Rich Beckman, the instructor for JOMC 491, Mike Schmidt, a professional multimedia website designer who is also enrolled in JOMC 491, and several other people with both limited and extensive multimedia editing experience. The information gathered from these conversations was combined with the original goals of this project to formulate the list of business requirements found below. Each business requirement has a unique identifier, a name, a description, and a list of related business requirements (indicated by their identifiers).

Business Requirement Entry Key

Name	**Name of this business requirement**
Identifier	**Unique identifier for this business requirement**
Related rules	**ID(s) of business requirements related to this one**
Description	Description of this business requirement.

Name	**Application and Presentation Access Ubiquity**
Identifier	**MMSB-BR 001**
Related rules	**MMSB-BR 002, MMSB-BR 003, MMSB-BR 004**

Description Access to the application and the multimedia presentations it creates must be nearly ubiquitous to users and viewers (without a need to distribute the application software itself or its generated multimedia presentations). This will likely necessitate that both elements of the application are web accessible and deliverable.

Name **Application and Presentation Deployment Ubiquity**
Identifier **MMSB-BR 002**
Related rules **MMSB-BR 001, MMSB-BR 003, MMSB-BR 004**

Description The MMSB must be built in such a way as to allow a broad spectrum of servers and server configurations to easily deploy it. The presentations generated by the MMSB must be accessible to most internet users utilizing only their currently installed software and computer settings. The minority of internet users who do not have the correct software and/or computer settings must be able to address this problem quickly and easily.

Name **Application Use Restriction**
Identifier **MMSB-BR 003**
Related rules **MMSB-BR 001, MMSB-BR 002, MMSB-BR 004**

Description The use of each MMSB implementation for asset management and presentation building must be restricted to a specified person or controlled group of people.

Name **Distributed User Support**
Identifier **MMSB-BR 004**
Related rules **MMSB-BR 001, MMSB-BR 002, MMSB-BR 003, MMSB-BR 009**

Description Due to the ubiquitous, distributed nature of the MMSB, there exists a need to handle simultaneous uses of the application's asset management and presentation-building functionality. Users must be aware of how their actions can affect others accessing the application at the same time. Additionally, potential problems caused by this synchronous use must be mitigated.

Name	**Multimedia Asset Management**
Identifier	**MMSB-BR 005**
Related rules	**MMSB-BR 006, MMSB-BR 007**
Description	Multimedia assets that will be used in the presentations created by the MMSB must be able to be organized, added to, deleted, moved, updated, and easily accessed. This must be done in a way that is simple, intuitive, and tightly integrated with the presentation-building functionality of the MMSB.

Name	**General and Medium-Specific Metadata Management**
Identifier	**MMSB-BR 006**
Related rules	**MMSB-BR 007, MMSB-BR 005**
Description	The MMSB must be able to add, edit, and remove medium-specific and general metadata to all media that is uploaded using the application. This metadata should describe information relevant to the asset's file, the presentation of the asset, and the asset within the context of the MMSB.

Name	**Multimedia Presentation Creation**
Identifier	**MMSB-BR 007**
Related rules	**MMSB-BR 008, MMSB-BR 010**
Description	The MMSB must allow users to create web-deliverable multimedia presentations in a simple and intuitive manner. This should be done in a way that minimizes the need for users to have in-depth medium-specific and multimedia editing knowledge.

Name	**Multimedia Presentation Flexibility**
Identifier	**MMSB-BR 008**
Related rules	**MMSB-BR 007, MMSB-BR 010**
Description	The MMSB must be able to create flexible multimedia presentations so as to allow a user to represent each of their presentations' chosen media assets in an appropriate manner. This requirement applies to all presentations' functionality and appearance.

Name	**Project Management Support**
Identifier	**MMSB-BR 009**
Related rules	**MMSB-BR 004**
Description	The MMSB must be able to facilitate effective management of ongoing projects. Users should be able to access multimedia presentations they have been working on in their most recent state after exiting and returning to the application. Additionally, the MMSB should facilitate distributed communication between users working on the same presentation or working with the same media assets.

Name	**Multiple Language Presentation Support**
Identifier	**MMSB-BR 010**
Related rules	**MMSB-BR 007, MMSB-BR 008**
Description	The MMSB must support presentations in multiple languages with minimal asset redundancy. This should apply to any asset's metadata that might show up in a presentation (captions, subtitles, descriptions, etc).

Name	**Support for Novel and Experienced Users**
Identifier	**MMSB-BR 011**
Related rules	**MMSB-BR 001**
Description	The MMSB should cater to users with both extensive and limited multimedia editing and content management experience. In doing so, the MMSB should attempt to accommodate the largest and most diverse user group possible and require a minimal initial learning commitment.

Functional Specifications

After identifying the business requirements of the MMSB and MMSP, it was then necessary to outline the applications' functional specifications. These specifications thoroughly describe the features and interactive principles of the MMSB and MMSP and are predominantly based on the business requirements and design decisions. They outline precisely how a user will interact with the MMSB and MMSP in order to perform various tasks. They also act as a guide for the development of the applications by specifically identifying what functionality needs to be developed. Below is a list of the functional specifications of the MMSB and MMSP. Each entry in this list includes a unique identifier, a name, a description, a list of related business requirements (indicated by their identifiers), and a priority rating (which indicates the importance of developing a specific function, relative to the goals and business requirements of the MMSB and MMSP).

Priority Key (in decreasing order of importance):

Essential	Very High	High	Medium	Low	Very Low	Optional

Function Entry Key

Name	**Name of this application function**
Identifier	**Unique Identifier for this application function**
B.R. ID	**IDs of Business Requirements addressed by this function**
Priority	**Priority of this function (from table above)**
Description	Description of this application function.

Name	**Username and Password Login System**
Identifier	**MMSB-FS 001**
B.R. IDs	**MMSB-BR 003**
Priority	**Essential**
Description	The MMSB will utilize a username- and password-based login system in order to restrict access to the application to a specific user or user group. Both of these identifiers must be submitted and verified before a user is granted access to the MMSB. Usernames and passwords will be checked against a database of acceptable users for each implementation of the MMSB.

Name	**Hierarchical Media File Browser & Manager**
Identifier	**MMSB-FS 002**
B.R. IDs	**MMSB-BR 002, MMSB-BR 005, MMSB-BR 006**
Priority	**Essential**
Description	The MMSB will contain a hierarchical drop-down tree, which will contain every media file and its location within a flat file system. This file tree will utilize intuitive, medium-specific icons to identify the type of each media asset and will allow the user to organize and locate these assets quickly and easily. Additionally, the use of a flat file system for file storage eliminates the need for any database software to be installed on the server on which the MMSB is located. Additionally, this tree will be augmented with several standard file management controls, including a search feature and tools for creating directories and uploading, downloading, and deleting files.

Name	**Upload Tool**
Identifier	**MMSB-FS 003**
B.R. IDs	**MMSB-BR 001, MMSB-BR 005, MMSB-BR 006**
Priority	**Essential**
Description	The MMSB will incorporate an upload tool that will allow users to select one or more files from their local computer and upload them to the repository of media files utilized by the MMSB. Uploaded files will be added to the hierarchical media browser in a location determined by the user before they are uploaded. Additionally, users will be able to specify new names for the files before they are uploaded to the MMSB server. Forcing users to upload new media files to the file repository utilized by the MMSB facilitates their distributed access and the application's ubiquity.

Name	**Multimedia Workspaces**
Identifier	**MMSB-FS 004**
B.R. IDs	**MMSB-BR 005, MMSB-BR 011**
Priority	**Essential**

Description The MMSB will incorporate a multimedia workspace feature, which will allow users to select, arrange, view, and interact with multiple media files at once, in an intuitive and familiar manner. This feature is intended to emulate a physical workspace (a tabletop, for example), by allowing a user to drag and drop media assets around a two dimensional space. Each multimedia workspace will have several sorting and arranging controls to facilitate the visual organization of media assets on the workspace. The MMSB will support multiple multimedia workspaces open and in use at the same time.

Name	**Multimedia Workspace To-Do/Notes System**
Identifier	**MMSB-FS 005**
B.R. IDs	**MMSB-BR 004, MMSB-BR 009, MMSB-BR 011**
Priority	**Medium**

Description MMSB multimedia workspaces will include a to-do/notes system, which will allow users to write, edit, save, and delete tasks and/or notes relevant to a specific workspace. This system will also allow users to supplement specified entries with message boxes that will appear on the workspace surface itself (much like a post-it note). Furthermore, the workspace to-do/notes system will facilitate inter-user communication and distributed project management, by allowing users to save and distribute task-based information and workspace notes (when other users look at a loaded workspace's to-do list or notes).

Name	**Save And Load Multimedia Workspaces**
Identifier	**MMSB-FS 006**
B.R. IDs	**MMSB-BR 004, MMSB-BR 005, MMSB-BR 009**
Priority	**High**

Description The MMSB multimedia workspaces will be able to be saved and loaded, allowing users to access a workspace in the same state it was saved in, at a later point in time. This functionality also allows a user to load a workspace and begin working on it where another user left off, facilitating cooperation between spatially and/or temporally distributed users.

Name	**Multimedia Workspace Media Boxes**
Identifier	**MMSB-FS 007**
B.R. IDs	**MMSB-BR 005, MMSB-BR 011**
Priority	**Essential**

Description

The MMSB's multimedia workspaces will display and identify media files using media boxes. Media boxes will function as the container for individual media elements and will also provide users with both general and media-specific controls for each of the media within a multimedia workspace. A video box, for example, will provide users with video playback controls and methods for resizing, moving, and hiding the video. Media boxes will function much like traditional GUI windows and are intended to further emulate the action of placing physical media elements on a tangible two-dimensional workspace. Unlike traditional GUI windows, however, media boxes will exhibit several physically-modeled behaviors, in order to better simulate their role as physical objects. These behaviors will include momentum for individual media boxes, the ability to gather several media boxes, and an intuitive scaling and rotation method for each media box. Together, these functions will allow users to interact with the multimedia elements in the MMSB much like they would with a similar physical medium (such as a photograph), resulting in an extremely intuitive and naturally familiar interface.

Name	**Media File Metadata Editor**
Identifier	**MMSB-FS 008**
B.R. IDs	**MMSB-BR 006, MMSB-BR 007, MMSB-BR 011**
Priority	**Essential**

Description

The MMSB will include a media file metadata editor, which will be built into the multimedia workspace component of the application. The metadata editor will allow a user to view, edit, and save both general and medium-specific metadata for each media asset. All metadata that may be displayed in a multimedia presentation will allow for multiple languages. The metadata editor will also incorporate a file queue, which will enable a user to rapidly edit metadata for multiple files. Additionally, the metadata editor's tight integration with the multimedia workspace feature will allow a user to transition seamlessly from organizing media assets to editing their metadata.

Generic metadata for all media files will include the asset's file name, file location, file type, file size, upload time, update time, creator information, asset description, and notes (for internal use). All visual media will contain dimensional metadata and all

sequential media will contain duration and subtitles metadata. Photo assets will contain caption information.

Name	**Multimedia Presentation Builder**
Identifier	**MMSB-FS 009**
B.R. IDs	**MMSB-BR 007, MMSB-BR 008, MMSB-BR 010**
Priority	**Essential**

Description

The MMSB will incorporate a multimedia presentation builder, which will be used to create multimedia presentations from the media files uploaded to the MMSB's media repository. The presentation builder will include controls for adjusting the duration of a presentation, creating and editing metadata for a presentation, and previewing a presentation while it is still in development. The multimedia presentation builder will also be tightly integrated with the MMSB's workspaces, allowing the user to easily move media assets between a workspace and the presentation builder.

Name	**Multimedia Presentation Timeline And Asset Viewer**
Identifier	**MMSB-FS 010**
B.R. IDs	**MMSB-BR 007, MMSB-BR 008, MMSB-BR 011**
Priority	**High**

Description

The timeline and asset viewer will be a component of the MMSB's presentation builder and will provide the user with an intuitive way to build and organize the assets added to a multimedia presentation. The timeline and asset viewer will have two different display methods: timeline mode and gallery mode. When in timeline mode, the presentation timeline will show media boxes for each asset in the presentation, positioned and sized according to their start time and end time in the presentation. As such, users will be able to adjust the size and position of these media boxes to manipulate their corresponding media files' start and end times in the presentation. The timeline will also support several different zoom levels and media box interaction principles when in timeline mode. When in gallery mode, the presentation timeline will show a fixed-size media box for each asset in the presentation, in the order in which they will appear in the presentation – without any visual indicator of their start time or duration. The two modes of functionality provided by this timeline will facilitate the creation of both sequential presentations and media galleries (in which a media file has no start and end time). Additionally, the timeline will be tightly integrated with the MMSB workspaces and file browser, allowing the user to easily add media assets to a presentation from these components, in the position he/she desires.

Name	**Save And Load Multimedia Presentations**
Identifier	**MMSB-FS 011**
B.R. IDs	**MMSB-BR 004, MMSB-BR 007, MMSB-BR 008, MMSB-BR 009**
Priority	**Essential**

Description The MMSB will be able to save multimedia presentations in two different ways and will be able to load a saved presentation for editing. The MMSB will support saving presentations as stand-alone presentations, which will produce a folder containing copies all the assets used in the presentation and a multimedia player file setup to use those assets. This folder can then be moved to different locations and the presentation will maintain its functionality, however, any updates in the MMSB to the assets used in these stories will not propagate to the stand-alone presentations. The MMSB will also support saving dependent multimedia presentations, which will reference the media files uploaded to the MMSB and reflect future changes to those media files. Only the latter of these types of saved presentations will be able to be loaded for further editing in the MMSB.

Name	**Check In And Out Workspaces, Presentations, And Assets**
Identifier	**MMSB-FS012**
B.R. IDs	**MMSB-BR 004, MMSB-BR 009**
Priority	**Medium**

Description When loaded or closed, saved MMSB multimedia workspaces and presentations will be labeled as checked out or checked in, respectively. By requiring that a user check out a saved workspace or presentation prior to the editing process, only one person will be able to edit that workspace or presentation at a time. When a user loads a workspace or presentation (thereby checking it out), it will be recorded as checked out, and any subsequent requests to load that workspace or presentation by other users will be denied, until it is checked back in. For individual media assets, this check-in/check-out process will be applied to them only during the metadata editing process. Overall, this restriction will help to mitigate the probability of overwritten data caused by a distributed user group.

Name	**Multimedia Sequential Presentation Playback**
Identifier	**MMSB-FS 013**
B.R. IDs	**MMSB-BR 007, MMSB-BR 008, MMSB-BR 010**

Priority	**Essential**

Description

The delivery aspect of the MMSB will be a multimedia player/viewer that is capable of displaying and controlling presentations created by the MMSB. The player will be web-based and as such, will support progressive download, bandwidth optimization, and on-demand loading of assets. The multimedia presentation player will also support a gallery mode, a sequential playback mode, and a dual mode (which will combine the sequential and gallery modes). When in sequential playback mode, the player will function like a typical movie player, such as a Windows Media Player or a Quicktime Player, and will control a sequential, timeline-based multimedia presentation. The player will enable the user to play, pause, and scrub through a multimedia presentation. Additionally, it will allow a user to jump to specific times in the presentation and resume playback from these times. The sequential presentation player will also indicate to the user the total and current time of the presentation, the title of the presentation, and the loading progress of the presentation's media.

Name	**Multimedia Gallery-Based Presentation Viewing**
Identifier	**MMSB-FS 014**
B.R. IDs	**MMSB-BR 007, MMSB-BR 008, MMSB-BR 010**
Priority	**Essential**

Description

The delivery aspect of the MMSB will be a multimedia player/viewer that is capable of displaying and controlling presentations created by the MMSB. The player will be web-based and as such, will support progressive download, bandwidth optimization, and on-demand loading of assets. The multimedia presentation player will also support a gallery mode, a sequential playback mode, and a dual mode (which will combine the sequential and gallery modes). When in gallery mode the player will function like a standard online photo gallery, but will contain a gallery of multimedia files, rather than just photos. In this mode, the player will utilize thumbnail images of each media file in a multimedia presentation to display the files in an organized, easily navigable, and readily identifiable manner. Users will be able to view these files by directly selecting them or by selecting them through the player's gallery controller, which will provide the ability to step through media files by viewing the next or previous file. When a user selects a media file for viewing, they will be provided with a medium-specific controller for that file. The file will then be loaded and the user will be informed of the loading progress. When enough of the file is loaded, the user will be able to manipulate the media file using its controller. When in gallery mode, the presentation

player will also allow users to filter the displayed media files based on their metadata content and media type. Additionally, it will indicate to the user the title of each media file in the gallery and the title of the presentation, itself.

Use Case Scenarios

After identifying both the business requirements and the functional specifications for the MMSB and MMSP, it was then necessary to identify the use case scenarios for the applications. Each use case scenario describes a specific task for which someone might use the MMSB or MMSP as well as a list of steps that he/she would take to complete the task. The use case scenarios help to identify potential oversights in the list of functional specifications and business requirements. They also help give context to the proposed functionality of the MMSB and MMSP, which in turn, helps in determining whether the design decisions are appropriate. Below is a list of the most prominent use case scenarios of the MMSB and MMSP. Each entry in the list includes the name of the task the use case addresses, a list of related business rules and functional specifications (indicated by their respective identifiers), a precondition, a course of events taken by the user to complete the use case's task, and a postcondition.

Use Case Scenario Entry Key

Task	**The task this use case addresses**
B.R. IDs	**ID(s) of business rules related to this scenario**
Function IDs	**ID(s) of functionality related to this scenario**
Precondition	The state of the participating actors and system prior to this scenario
Course of Events	Set of steps taken in this use case scenario to complete a specific task.
Postcondition	The state of the participating actors and system after the completion of this scenario

Task	**Adding Media Assets and Viewing them in the MMSB**
B.R. IDs	
Function IDs	
Precondition	John is a registered user of an implementation of the MMSB that contains no media assets, saved workspaces, or saved presentations.
Course of Events	**Trigger:** John wants to organize and view several media files he has on his computer using the MMSB, in preparation for creating a multimedia presentation with them.

1. John navigates to the URL of the MMSB implementation that he is going to use to organize and view his media files.
2. The MMSB prompts John to verify his identity as a registered user of this MMSB implementation.
3. John provides the MMSB with his unique identification information.
4. The MMSB checks whether a registered user exists with the same identifying information that was provided by John.
5. The MMSB confirms John as a registered user and provides him access to all the MMSB's functionality.
6. John requests to add media files from his computer to the repository of media files stored by this MMSB.
7. The MMSB provides John with a way to select the files he wishes to add to the MMSB media repository.
8. John selects the files he wishes to add to the MMSB media repository and requests that they be added.
9. The MMSB prompts John to specify where he would like the files to be added (within the media repository).
10. John specifies where (within the media repository) the media files are to be added.
11. The MMSB copies the files from John's computer to the location he specified (within the media repository).
12. The MMSB notifies John of the progress of the addition of each file (iterative for each file).
13. When all of his files have been added to the MMSB media repository, John finds a file he added by looking in the location that he requested the file to be added at.
14. John selects the media file and requests to view it.
15. The MMSB provides John with a set of media-specific controls for the requested file and shows John the media file.
16. Steps 12-14 are repeated for each media file that John added, without replacing the files he viewed from previous iterations.
17. John views and compares the media files within the context of the entire body of files.

Postcondition The MMSB contains all the files John added to it, in the locations that he specified when he added them. All of the media files are displayed for John, along with a set of media-specific controls for each file.

Task **Adding and Editing Metadata to the MMSB's Media Files**
B.R. IDs
Function IDs

Precondition John and Jane are registered users of an implementation of the MMSB that contains several media files previously added to the media repository. These files may or may not already have user-defined metadata.

Course of Events **Trigger:** John and Jane want to create and edit the metadata for several media files contained within an implementation of the MMSB in order to improve their accessibility and prepare them for use in a multilingual multimedia presentation.

1. John navigates to the URL of the MMSB implementation that contains the files he intends to edit.
2. The MMSB prompts John to verify his identity as a registered user of this MMSB implementation.
3. John provides the MMSB with his unique identification information.
4. The MMSB checks whether a registered user exists with the same identifying information that was provided by John.
5. The MMSB confirms John as a registered user and provides him access to all the MMSB's functionality.
6. John selects a media file from the MMSB's media repository and requests to view its metadata.
7. The MMSB displays the requested media file, along with a media-specific controller, and shows John the categorized metadata that has been recorded for that file.
8. John examines the file's metadata and decides to add some missing information. John enters the supplemental information into specific metadata categories. John also notices some inaccuracies in the file's metadata and corrects them. When he is satisfied, John requests that the new metadata be saved.
9. The MMSB saves the edited version of the metadata as the metadata associated with the current media file.
10. Steps 6-9 are repeated until John is satisfied with the metadata for each media file.
11. John exits the MMSB.
12. Jane repeats steps 1-6.

13. Jane repeats step 7.
14. Jane examines the file's metadata, which now reflect the changes John made, and adds new language definitions for several metadata categories. Jane then translates the file's existing categorical metadata into several languages, adds the translated metadata to their defined language-categories, and requests to save the new multilingual metadata.
15. The MMSB saves the edited version of the metadata as the metadata associated with the current media file.
16. Steps 13-15 are repeated until Jane is satisfied with the multilingual metadata for each media file.
17. Jane exits the MMSB.

Postcondition All the media files in this implementation of the MMSB have saved multilingual metadata that reflects the changes made by John and Jane.

Task **Creating, Editing, and Saving a Multimedia Presentation**
B.R. IDs **ID(s) of business rules related to this scenario**
Function IDs **ID(s) of functionality related to this scenario**

Precondition Jane is a registered user of an implementation of the MMSB that contains several media files previously added to the media repository. These files already have relevant metadata approved by Jane.

Course of Events **Trigger:** Jane desires to create a multimedia presentation using the MMSB and the files already in its media repository. Jane may or may not have the time to complete the presentation all at once.

1. Jane navigates to the URL of the MMSB implementation that contains the files she intends to edit.
2. The MMSB prompts Jane to verify her identity as a registered user of this MMSB implementation.
3. Jane provides the MMSB with his unique identification information.
4. The MMSB checks whether a registered user exists with the same identifying information that was provided by Jane.
5. The MMSB confirms Jane as a registered user and provides her access to all the MMSB's functionality.
6. Jane requests to create a new multimedia presentation using the media files stored in the MMSB.
7. The MMSB prompts Jane for initialization information about the presentation.
8. Jane specifies initial setup information about the presentation, such as its type (sequential or gallery-based) and various

categorical metadata, then indicates when she is satisfied with the information.
9. The MMSB associates the information Jane provided with a new presentation and displays an interface for Jane to edit the newly created presentation.
10. Jane locates media files and adds them to the presentation in the order she desires them to be displayed (including their chronological locations, if applicable).
11. As she works, Jane previews the presentation she is building to get a better sense of how it will be displayed to its end viewers.
12. Jane repeats steps 10-11 until she is satisfied with the multimedia presentation or must stop working on it, at which point she requests to save it.
13. The MMSB saves the presentation and a copy of the multimedia player that will be used to control it (if specified by Jane, the MMSB will also copy the included assets into separate, stand-alone presentation folder).
14. Jane exits the MMSB, and links to the newly created multimedia presentation on her website.
15. At a later date, Jane repeats steps 1-5.
16. Jane requests to edit the multimedia presentation she was working on previously.
17. The MMSB loads the information about Jane's presentation and opens the presentation editor in the same state as when Jane saved her presentation.
18. Jane continues working on the presentation (repeating steps 10-11 as necessary), and again requests to save it when she is satisfied.
19. Steps 13-14 are repeated.

Postcondition A new multimedia presentation has been created and is ready for viewing on the web. Additionally, the MMSB can now load this presentation for a user to edit it further.

Task **Managing a Multimedia Project Among Distributed Users**
B.R. IDs **ID(s) of business rules related to this scenario**
Function IDs **ID(s) of functionality related to this scenario**

Precondition John and Jane are registered users of an implementation of the MMSB that contains several media files previously added to the media repository. These files already have user-defined metadata. John and Jane are in different physical locations and access the MMSB using different computers.

Course of Events **Trigger:** John and Jane want to collaborate to build a media presentation that is relevant to them both using the media files

already in the MMSB.

1. Jane navigates to the URL of the MMSB implementation that contains the files she intends to edit.
2. The MMSB prompts Jane to verify her identity as a registered user of this MMSB implementation.
3. Jane provides the MMSB with his unique identification information.
4. The MMSB checks whether a registered user exists with the same identifying information that was provided by Jane.
5. The MMSB confirms Jane as a registered user and provides her access to all the MMSB's functionality.
6. Jane adds several media files to a new workspace, which she believes are relevant to the presentation she and John will be working on.
7. Jane creates some notes associated with the workspace, which ask John to approve her media choices and add any files to the workspace that he believes should be included in their presentation.
8. Jane saves the workspace, and notifies John that he should take a look at it.
9. John repeats steps 1-5.
10. John loads the workspace Jane created and sees the files she has added to it, as well as the notes she created.
11. John creates a note about some of Jane's media choices being potentially inappropriate and adds some additional media files that he believes should be included in their presentation.
12. John deletes the notes Jane wrote, saves the workspace, logs out of the MMSB, and notifies Jane to take a look at his changes when she gets a chance.
13. Jane repeats steps 9-10.
14. Jane appends her rationale for including her chosen media files to the notes John created, saves the workspace and logs out.
15. John and Jane continue adding and replying to the workspace's notes until they are each satisfied with the media files on that workspace.
16. Jane repeats steps 1-5.
17. Jane uses the media files she and John have agreed upon to create media presentation with them (using the MMSB's multimedia presentation-building functionality – see the use case: Creating, Editing, and Saving a Multimedia Presentation).
18. John and Jane edit the presentation iteratively, communicating to each other in a similar manner to their previous workspace-related communication, until they are satisfied with the presentation they have created.

Postcondition	The MMSB contains a saved multimedia presentation that is the result of a collaborative effort by Jane and John. This presentation is ready for viewing on the web.
Task	**Viewing and Controlling a Sequential Multimedia Presentation**
B.R. IDs	**ID(s) of business rules related to this scenario**
Function IDs	**ID(s) of functionality related to this scenario**
Precondition	A sequential multimedia presentation has been created and saved in the MMSB and has been made available for viewing on the web.
Course of Events	**Trigger:** John has learned of the multimedia presentation described in this use case's precondition and desires to view the presentation.

1. John navigates to the URL multimedia presentation and is presented with the MMSP associated with that multimedia presentation.
2. The MMSP loads the media files and configuration information necessary to play the multimedia presentation John has requested to view. The MMSP continuously informs John of its progress during this loading process.
3. The MMSP informs John when it is ready to begin playback of the presentation.
4. John requests to start playing the presentation.
5. The MMSP begins playing the presentation.
6. When the presentation finishes playing, John wishes to view a specific segment of the presentation again. John scrubs through the presentation in order to locate the desired segment.
7. When John finds the segment he wishes to view, he requests to begin playback of the presentation from the beginning of that segment.
8. The MMSP begins playback of the presentation from the point in time that John specified.
9. After watching the presentation some more, John requests to pause the playback of the presentation at a certain point in time.
10. The MMSP pauses the presentation's playback.
11. John continues examining the presentation using the aforementioned MMSP playback controls until he is satisfied, at which time he closes his web browser (thus closing the MMSP).

Postcondition	A sequential multimedia presentation has been created and saved in the MMSB and has been made available for viewing on the web. John has now viewed this presentation.

Task	**Viewing and Controlling a Gallery-Based Multimedia Presentation**
B.R. IDs	**ID(s) of business rules related to this scenario**
Function IDs	**ID(s) of functionality related to this scenario**

Precondition

A gallery-based multimedia presentation has been created and saved in the MMSB and has been made available for viewing on the web.

Course of Events

Trigger: Jane has learned of the multimedia presentation described in this use case's precondition and desires to view the presentation.

1. Jane navigates to the URL multimedia presentation and is presented with the MMSP associated with that multimedia presentation.
2. The MMSP loads the configuration information necessary to display the multimedia presentation Jane has requested to view. The MMSP then sequentially loads, organizes, and displays thumbnail images of the presentation's media files. Additionally, the MMSP provides Jane with controls for navigating through these files.
3. Jane requests to view a media file by selecting the file out of the gallery.
4. The MMSP begins to load that media file, again keeping Jane informed of its progress.
5. When enough of the media file is loaded, the MMSP displays the media file and provides Jane with media-specific controls for that file.
6. Jane uses the controls to examine the media file to her satisfaction and then requests to see the gallery of media assets again.
7. The MMSP closes the media file and removes its controller and returns to the media gallery that was displayed in step 2.
8. Jane requests to filter the gallery to only include photos related to a specific subject (which Jane provides to the MMSP).
9. The MMSP compares the metadata of each photo to the subject requested by Jane and filters the gallery to only include photo media related to Jane's specified subject.
10. Jane uses the gallery controls to step through the filtered files, in order and one by one.
11. For each photo, the MMSP repeats steps 4-5.
12. When Jane is finished looking at the media files, she closes her web browser (thus closing the MMSP).

Postcondition

A gallery-based multimedia presentation has been created and saved in the MMSB and has been made available for viewing on the web.

Design Decisions

In order to accommodate the broadest possible user group, the MMSB and MMSP incorporate design and interaction principles that attempt to maximize the intuitiveness with which a person can use the application to achieve his/her goals. Because the MMSB represents a particularly complex and potentially overwhelming application, special attention was paid to making it usable for people with or without extensive computer and multimedia experience. To achieve this, the interface of the MMSB attempts to replicate several interaction principles a user might experience when organizing multimedia objects in the real world. These principles include dragging, dropping, sliding, and placing multimedia objects on a two dimensional space in order to achieve various organizational and systemic functionality. Unlike the MMSB, the MMSP represents a far simpler and more pervasive type of application. Its user interface relies more heavily on preexisting standards set by existing multimedia players. Together, these guiding principles will help to make the MMSB and MMSP an intuitive and effective tool for the management and creation of multimedia presentations.

Multimedia Story Builder Design Decisions

As mentioned before, the MMSB is intended to accommodate a very broad user group. Because the MMSB is an inherently complex and relatively uncommon application, it must do so in a graphically simple and intuitive manner. The interface principles of the MMSB are based on the psychological principles of manipulating real-

world physical objects – principles that are naturally intuitive to users with or without extensive multimedia or computer experience (Norman 8-11). In the MMSB, these principles are manifested in a user's ability to drag, place, slide, and arrange objects freely in a virtual two-dimensional space, using the same methods that he/she would in the real world. These interaction principles significantly mitigate the need for users to have extensive experience with computers or multimedia editing and allow them to begin using the MMSB with little or no previous instruction.

In order for a user to manipulate a specific media file, it is necessary for him/her to first find, identify, and select it from all of the files in the MMSB's media repository. This is achieved by providing the user with a hierarchical file tree, supplemented with medium-specific icons. This file tree contains all of the files in the MMSB's media repository and is the starting point for all operations involving a specific media file. A hierarchical file tree was chosen for this part of the application for two reasons: 1) its ubiquity among existing digital file systems and 2) its accuracy in visually representing files and their locations in the MMSB's media repository. Because hierarchical file trees are utilized in both Mac OS and Windows, it can be assumed that around 97% of MMSB users will have experience using them ("Market Share for Browsers…"). Additionally, because the MMSB stores its media using the traditional hierarchical filing system utilized by most operating systems, a hierarchical file tree accurately represents a file's location in relation to other files and directories.

When a user finds and identifies a media file he/she wants to manipulate in the hierarchical file tree, he/she must drag the file from the tree to one of several locations in the MMSB, depending on the function the user wishes to perform. Almost all media-

related actions in the MMSB are performed using this paradigm of movable objects within a two-dimensional space. This methodology has been shown to be an exceptionally intuitive method for the informal organization and manipulation of files in systems similar to the MMSB and provides users with interaction principles that are familiar from their interactions with everyday objects (Agarawala 1290-1291).

The primary containers for media files selected and dragged from the MMSB's hierarchical file tree are media tables. A media table is a digital representation of a physical table top, onto which a user can place any number of various media files supported by the MMSB (Figure 5). This process requires a user to drag a file from the hierarchical file browser to the location that he/she wishes to place the file on an open media table. When a media file is placed onto a media table in this manner, it takes the form of a media box. Accordingly, a media box is the graphical representation of a media file on a media table. All media boxes residing on a media table can be moved, placed, rotated, scaled, removed, gathered, and thrown – much like objects resting on a real table top. Additionally, specific media boxes may provide medium-specific playback controls, which are determined by the type of medium they represent (audio, video, text, photo, etc.).

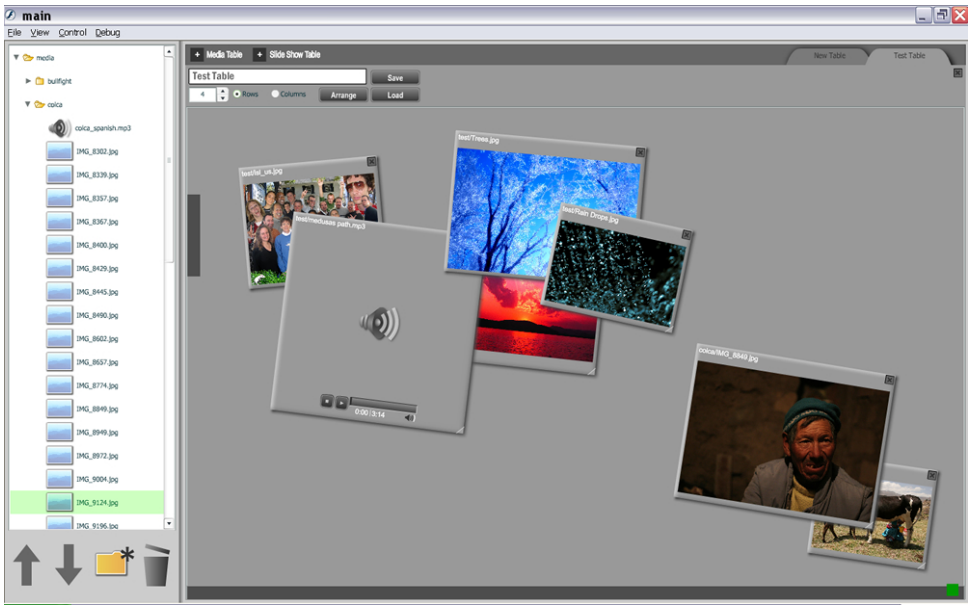


Figure 5. A media table with media boxes on it

The ability to move media boxes around a media table provides users with much of the organizational functionality afforded by manipulating physical objects on a real table top. Unlike in the real world, however, spatially organizing media boxes on a media table does not affect their digital organization in any way (except graphically on the screen). Despite this, support for spatial organization of files provides users with the functionality necessary to create various personally-relevant organizational scheme. These schemes can include such informal devices as stacks, piles, groups, and heaps of media boxes (Mander 628, 629).

In addition to being a means for viewing and organizing media files, the MMSB media tables are augmented with other functionality, as well. All media tables include tools for organizing media boxes that have been placed on them. This functionality allows a user to neatly and efficiently sort and arrange all of a media table's media boxes according to various criteria, allowing a media table to retain much of the organizational functionality afforded by a computer. This augmentation of the physical-world

functionality exhibited by MMSB media tables is something that users have identified as being important in previous studies that have examined similar digital interfaces (Grant, et al. 8,9).

In addition to the aforementioned sorting and arranging tools, all media tables also incorporate a to-do system that can be used to emulate the real-life Post-It note-based organizational systems already utilized by many people. To-do items within a media table's to-do list can be added to, edited, and deleted. Additionally, users have the option of augmenting any of these items with a virtual Post-It note, which can be attached to the surface of the media table associated with that to-do item. This system incorporates the rigid and defined organizational structure of a traditional digital to-do system (via the to-do list), with the more informal structure of recording to-do items in the physical world (in this case, via digital Post-It notes). And, in providing the user with both of these functions, the MMSB further incorporates the already pervasive physical-world paradigm, but also augments with more traditional computer-based functionality.

MMSB users may choose to open media tables with special functionality that supplements the previously described sorting and to-do list functionality. The MMSB provides two types of these special tables to users: 1) media editor tables and 2) presentation editor tables. Media editor tables incorporate all of the functionality of media tables, but also allow users to edit the metadata of the media files associated with the media boxes on the table. This is done by allowing users to add one or more of the table's media boxes to a special metadata editor. The metadata editor is a collapsible tool that appears to sit on top of the media editor table. The metadata editor has an opening into which a user may place a media box. If a media box is placed in this opening, a

medium-specific metadata form is provided to the user, which he/she may use to edit the metadata for the media file associated with the active media box (Figure 6). When a user is finished editing the metadata of a media file, he/she simply drags the media box out of the metadata editor or closes the media box altogether. This method of selecting a media file for editing adheres to the physical-world paradigm of manipulating objects in a two-dimensional space incorporated throughout the MMSB, increasing its intuitiveness within the overall functionality of the MMSB.

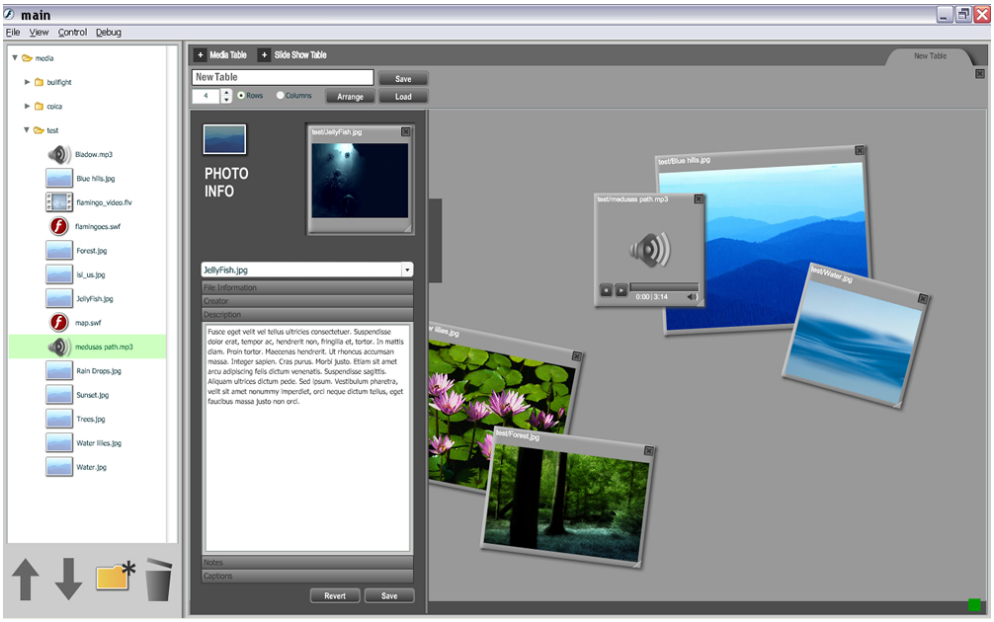


Figure 6. The metadata editor with a media box in it

Like media editor tables, presentation editor tables also incorporate all of the functionality of a standard media table, but they include tools for creating multimedia presentations using the table's media boxes, as well. Creating and editing a multimedia presentation is achieved by dragging media boxes from a presentation editor table onto and around the timeline of a multimedia presentation editor (Figure 7). The multimedia presentation editor is similar to the metadata editor tool, in that it appears to be positioned on top of a presentation editor table. The timeline of a presentation editor appears to be a

long opening, onto which media boxes can be placed. Media boxes placed on this timeline will be temporally ordered in a multimedia presentation in the same order as they appear spatially on the timeline (from left to right). Additionally, in sequential presentations, the duration of each media file will correspond to the width of that media file's media box on the presentation editor's timeline. This method of spatially-based temporal data manipulation has been shown to be effective in editing sequential presentations and represents an interaction principle that fits with the overall interaction paradigm utilized by the MMSB (Bobrowicz 5-7).

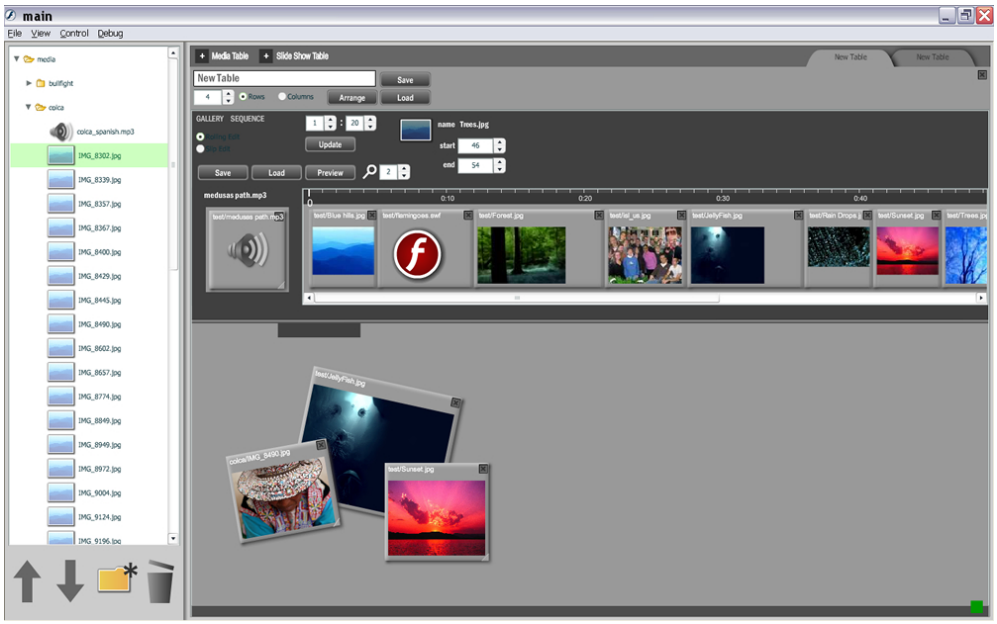


Figure 7. A presentation editor table and its multimedia presentation editor

Together, media editor tables and presentation editor tables provide users of the MMSB with intuitive and consistent methods for viewing, organizing, and manipulating media files and creating and editing multimedia presentations. Additionally, the drag and drop principles that are thoroughly incorporated in the MMSB provide users with interaction methods that adhere to natural psychological design principles (Norman 8-11). This focus helps to broaden the user group that is accommodated by the MMSB and

minimize the time and effort required by these potential users to effectively operate the MMSB.

Multimedia Story Player Design Decisions

As previously mentioned, the design decisions for the MMSP are based on standards set by existing multimedia players. The relative ubiquity and graphical similarity of these players has familiarized many people with their operation and interaction principles (Figure 8). In fact, by only examining two such players, Windows Media and QuickTime, it can be assumed that around 97% of potential MMSP users will have experience using a preexisting multimedia player ("Market Share for Browsers…"). This is due to the fact that Windows Media and QuickTime players come standard on Windows and Mac OS, respectively, which together comprise 97% of the all personal computer operating systems ("Market Share for Browsers…"). This relative ubiquity of similar preexisting multimedia players among the intended user group of the MMSP warrants the incorporation of the user interface standards they have already established.

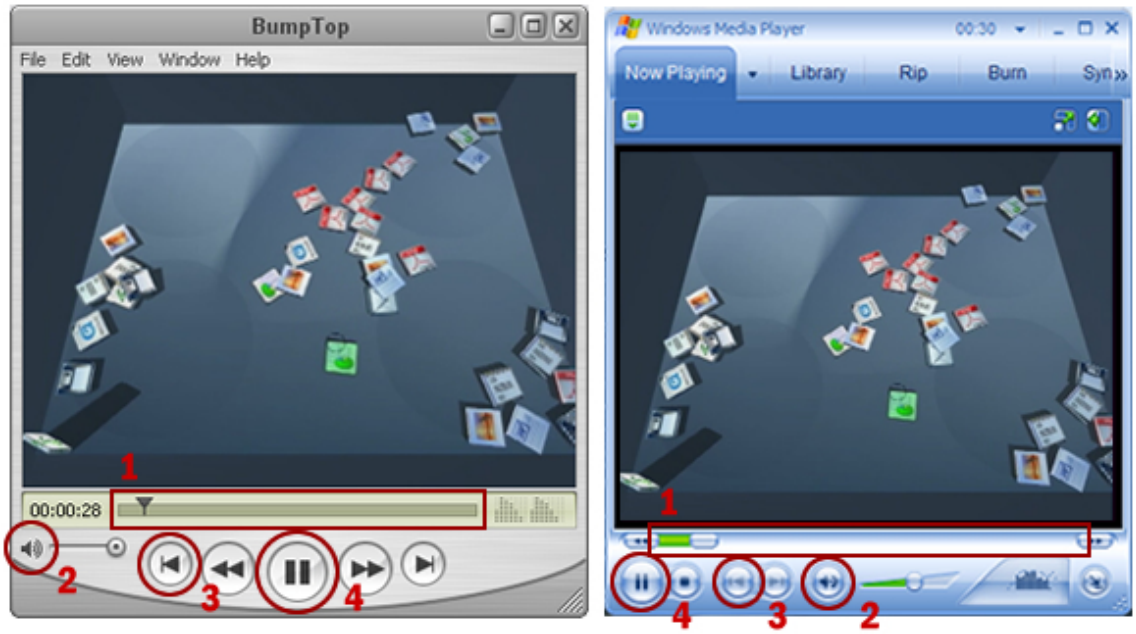


Figure 8. Comparison of QuickTime (left) and Windows Media (right) player control interfaces.

1. Scrubber Bar
2. Volume Icon
3. Reset Button Icon
4. Play/Pause Button (showing pause icon)

When controlling sequential multimedia presentations, the MMSP will incorporate such standardized features as play, pause, and stop controls, a scrubber bar, a timer, and a volume controller (Figure 9). The scrubber bar is a tool that allows users to graphically see where they are temporally in a sequential presentation. This is achieved by constantly updating the horizontal position of a play head symbol on a scrubber bar background based on the current temporal position of the presentation (the width of the scrubber bar represents the duration of the presentation). The scrubber also allows a user to explicitly manipulate the temporal position of a sequential presentation by dragging the play head along the scrubber bar background or by clicking on the scrubber bar background to make the play head (and presentation) jump to that point in time. This type of scrubber bar is a common tool for controlling a sequential multimedia presentation among

preexisting multimedia players, and as such, it is also a tool that should be familiar to users of the MMSP. The play, pause, and stop buttons will be identified through the use of standard playback icons. These should not only be familiar to users of the MMSP, but they should also help to provide consistent usability standards across a range of different languages.

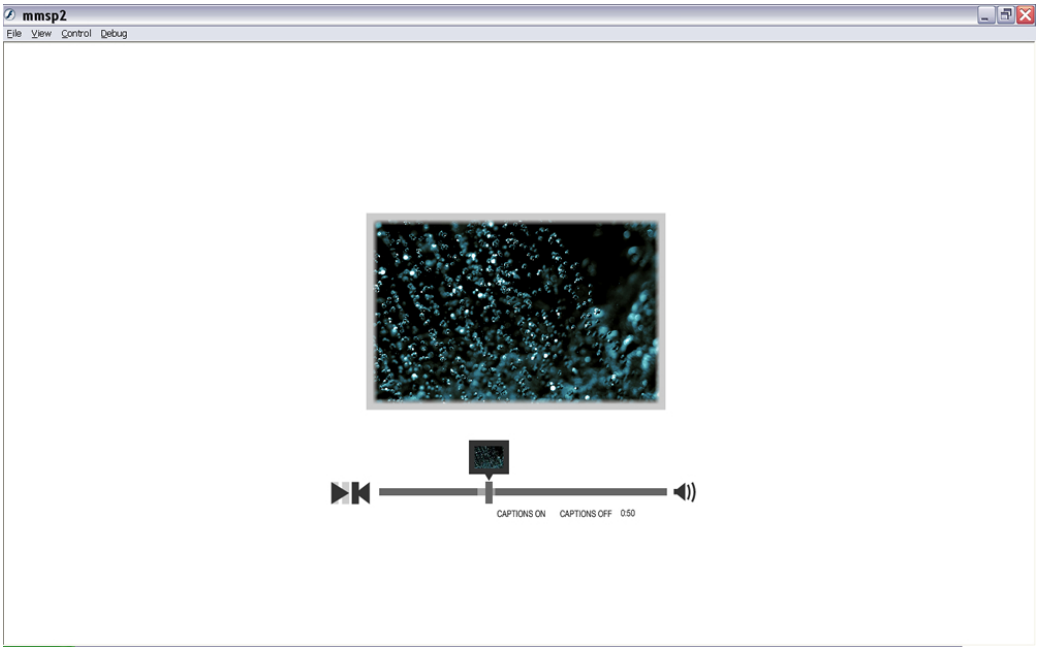


Figure 9. The MMSP graphical user interface during playback of a sequential presentation

When controlling gallery-based presentations, the MMSP will provide its users with a different set of controls than when controlling sequential presentations. These gallery controls will include tools for freely navigating and previewing the media elements included in a presentation, jumping to the previous or next media element in a presentation, and controlling each media element with a medium-specific controller (Figure 10.). Like in the sequential presentation controls, the controls for a gallery-based

presentation will be identified primarily through standardized icons, minimizing the learning curve faced by new and multilingual users.

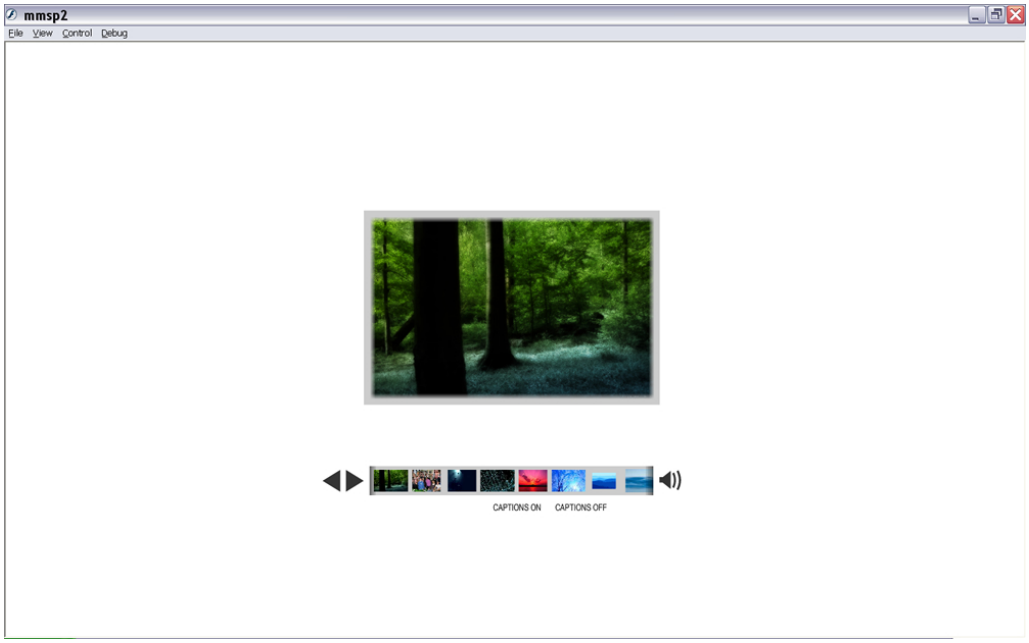


Figure 10. The MMSP graphical user interface during playback of a gallery-based presentation

Risk Assessment and Management

The use of the MMSB as a solution for the creation and management of multimedia presentations and their assets inherently involves some risks. These risks, however, have been identified and mitigated where possible. Below is a list of these identified risks, and the steps that have, or will be taken to mitigate them. Each entry in the list includes a risk name, a probability that the risk will occur, a description of the potential impact of the risk, and a description of the risk itself. Additionally, each entry includes a name for the proposed solution to the risk, a description of the expected effectiveness of the proposed solution, and a description of the proposed solution.

Risk Entry Key

Risk	**The event that embodies this risk**
Probability	**The probability of this risk event happening**
Impact	**The potential impact of this risk event**
Description	The description of this risk
Solution	**The proposed or actual solution to this risk (if applicable)**
Effectiveness	**The expected effectiveness of this solution in mitigating this risk**
Description	The description of this risk solution

Risk	**Loss of Data**
Probability	**Variable (depending on implementation environment)**
Impact	**Major**
Description	As with any application that utilizes digital storage methods, the MMSB exhibits the potential for experiencing lost, corrupted, or otherwise inaccessible data. This risk is present for all types of

persistent data stored by the MMSB, including media files, media metadata, presentation information, user and login information, and the scripts that comprise the MMSB itself. The risk of data loss is most significantly affected by factors outside of the MMSB, though, including the environment in which it is deployed and the maintenance of this environment. As such, this risk extends beyond the scope of the MMSB.

Solution **Iterative Versioning for Persistent Files**
Effectiveness **Moderately Effective**
Description Information and metadata files, including media metadata files, presentation information files, and user and login information files, will be iteratively saved and maintained. This process will result in the existence of several versions of each of the aforementioned files, mitigating the data loss that would result if one of these files was lost, corrupted, or otherwise rendered inaccessible. If the most recent version of one or more of these files is lost, a user will be able to retrieve that file in its most recent state prior to its current state. And, while this functionality would not allow the user to retrieve an exact copy of the file that was lost, it would allow the user to potentially retrieve a majority of the information contained in the lost file. This solution should be a sufficient method of file backup, considering the relative rarity of file loss and the limited responsibility the MMSB has in addressing the risk of data loss.

Risk **Overwritten Data or Undesired Changes by Other Users**
Probability **High**
Impact **Moderate – Major**
Description The risk of users overwriting or changing data created by other users in an undesired manner is a risk that is inherent to all applications that accommodate a user group greater than one person. The MMSB is no different from these applications and faces this problem in its media metadata files, media files, saved presentations, and saved workspaces. Because multiple users have the ability to access and manipulate all of these types of persistent data, they also have the ability to change them in a potentially undesirable way.

Solution **Iterative Versioning for Persistent Files; User permissions**
Effectiveness **Very Effective**
Description In addition to being a solution for mitigating the risk of data loss, iterative versioning of persistent files allows users to revert a file to a previous state, effectively undoing any undesired changes by another user. In addition to this functionality, the MMSB will also support the assignment of specific privileges to each user. These privileges will limit the actions users can perform in the MMSB,

inhibiting the chances of overwriting or changing persistent data in a manner that may be undesirable to another user (by necessitating that users be qualified to edit the information they are able to edit).

Risk	**Inability to Access the Application**
Probability	**The probability of this risk event happening**
Impact	**Minor – Moderate**
Description	Because the MMSB is a restricted-use, web-delivered application, there is an inherent risk that users may not be able to access it for a variety of reasons. In order to access the MMSB, a user needs to have internet access, the correct software installed on his/her computer, and his/her login information. If a user is lacking any of these, he/she will not be able to access the MMSB and utilize its functionality. The potential implications of this include lost production time, the inability of a user to access the application permanently, and a delay in the updating or creation of existing multimedia presentations.
Solution	**Flat File Storage of Persistent Data; Login Information Reminder**
Effectiveness	**Ineffective - Very Effective**
Description	Because the MMSB is a restricted-use, web-delivered application, there are several circumstances in which a user could lose access to the application. There is no way to allow a user access to the application if he/she does not have web access. The distributed nature of the MMSB demands that it be delivered via the internet, and as such, necessitates that its users have access to the internet. A user's inability to the access the MMSB due to lost or forgotten login information is, however, something that can be mitigated. This will be done by incorporating functionality that allows a user to retrieve their login information, upon providing an alternate means of identification (and one that is not easily forgotten). Additionally, all persistent data related to the MMSB will be stored in a flat file structure, allowing authorized users to access it using applications other than the MMSB (such as FTP clients, web browsers, or SSH applications).

Risk	**External File Manipulation**
Probability	**The probability of this risk event happening**
Impact	**The potential impact of this risk event**
Description	Because some users are able to access the same data used by the MMSB using separate and unrelated applications, it is possible to manipulate these data in ways that are unsupported or unrecognized

by the MMSB. Specific examples of this include deleting files included in a multimedia presentation using an FTP client, editing the metadata of a media file via a text editor and in a manner that is unrecognized by the MMSB, or editing the information file that defines a multimedia presentation via a text editor and in a manner that is unrecognized by the MMSB. These outside changes can have unpredictable and potentially detrimental effects on the functionality of the MMSB.

Solution **Redundant File Validation**

Effectiveness **Ineffective - Moderately Effective**

Description

A user has the ability to manipulate the files used by the MMSB with separate applications and in a nearly limitless number of ways. As such, this risk is difficult, if not impossible, to manage effectively. Despite this, however, several steps will be taken in the programming of the MMSB to help mitigate the effects of this risk. Files will be confirmed as existing before every access attempt by the MMSB. If the file is found to be nonexistent, the MMSB will perform the same steps that are taken if that file is deleted using the MMSB. Additionally, the MMSB will generate metadata automatically for media files that do not have metadata files already associated with them (which happens if a user uploads media to the MMSB media repository using an application other than the MMSB). If a user manipulates the content of files used by the MMSB in an unrecognized manner, the MMSB will replace that corrupted file with the most recent saved version of that file (if it exists and is not corrupt). This functioality can potentially result in some data loss and only represents a partial solution to this problem.

Implementation and Testing

The MMSB was implemented and observed in JOMC 491 (the UNC-CH multimedia documentary journalism class described in the *Background and Application Justification* section of this paper) between November 2, 2006 and November 10, 2006. The MMSB was made available to the students enrolled in this class after they attended a brief (10 minute) presentation on its capabilities and interaction principles. The students then used the MMSB over the next three days to both manage and create multimedia presentations about the people and culture of Arequipa, Peru. The presentations were all sequential in nature and included photos, audio, video, and text media. Qualitative information about using the MMSB during this time period was informally gathered via email and directly gathered via face-to-face interviews (Appendix D) with the student users. This information was then synthesized and analyzed in order to produce a cursory examination of the current usability of the MMSB and to identify potential areas for its improvement. This information is also meant to be used to suggest more formal and rigorous testing scenarios for evaluating the MMSB in the future.

Testing User Group

Definition and Scope

Eighteen students participated in the initial testing of the MMSB, all of whom were enrolled in JOMC 491, a documentary journalism class offered by the UNC-CH School

of Journalism and Mass Communication. These students are all English-speaking, high-school graduates, between the ages of 19 and 32. Four of the students are graduate students, one is a college graduate, and the rest are undergraduate students. The majority of the students enrolled in JOMC 491 have already completed an identical or similar class prior to this semester and thus have experience building multimedia presentations (using the various MPAs utilized by their previous classes – not the MMSB).

Psychological Characteristics

Sixteen of the 18 student participants in this testing scenario indicated that they were excited about using the MMSB. The remaining two students expressed indifference toward using the MMSB. The previous MPAs used to create the multimedia presentations for this and similar classes were generally disliked by the students who had experience using them. This resulted in a nearly ubiquitous desire to use a new MPA among the class' students, who therefore exhibited initial feelings of optimism and approval for the MMSB.

Knowledge and Experience

The students enrolled in JOMC 491 have diverse areas of background expertise and varying degrees of multimedia editing and content management experience. The class is made up of photographers, videographers, audiographers, graphic designers, and programmers. Most of the students' experience relevant to creating, managing, and editing multimedia presentations comes from using MPAs in previous classes similar to JOMC 491. All of the students who participated in this testing scenario have extensive experience using the internet and are competent using a computer.

Physical Characteristics

The 18 students who participated in the initial testing of the MMSB consisted of 6 females and 12 males. As previously mentioned, the participants were between the ages of 19 and 32, most of whom were 25 years old or younger. None of the student participants exhibited any physical or mental disability that would inhibit them from using the MMSB.

Information Gathering Process

The information from the initial testing of the MMSB in JOMC 491 was gathered via two in-class interviews and constant email contact throughout the week of testing. The interviews were conducted on November 7th and 9th between 2pm and 4pm (the meeting time of the class) and loosely adhered to two prewritten scripts (Appendix D). These interviews solicited general information about using the MMSB, including information about its users' initial learning procedures, the adequateness of the application's functionality, and details about the overall satisfaction of its users. The interview scripts were used to guide the conversations with each student but also allowed for a flexible dialogue, which often included questions not explicitly included in the scripts. During each interview, the interviewer wrote down the main points of the interviewee's responses. This information was later compiled and analyzed.

Throughout the week of testing, similar information was also gathered about the MMSB via email. The students enrolled in JOMC 491 were provided with an informational handout (Appendix C) prior to gaining access to the MMSB. This handout included an email address for the students to use to report any usability issues, functional

limitations, questions, or comments relating to the MMSB. Using email to solicit feedback provided the students with a method to communicate their comments about the MMSB as they arose during its use – independently of the time or student's location (both of which limited the information gathered via the interviews). The information gathered via email was later used in conjunction with the information gathered from the in-class interviews to preliminarily determine the general effectiveness of the MMSB.

Results

The information gathered from the student interviews was synthesized with the information gathered from the students' emails and analyzed. During this process, three categories emerged into which most of the student feedback could be placed: 1) the process of learning to use the MMSB, 2) the effectiveness and efficiency of task performance using the MMSB, and 3) the functionality incorporated into the MMSB. These three categories effectively encompassed nearly all of the feedback gathered from the students of JOMC 491 and provided an organized approach to evaluating the MMSB using this feedback.

Learning to Use the MMSB

As expected, information gathered early in the testing process (prior to November 7th) related primarily to learning how to use the MMSB. A vast majority of the feedback from the first set of interviews was positive in this regard, while the opposite held true for the information gathered via email (however only four emails were received relating to the MMSB learning process). This information indicated a strong preference for the drag-

and-drop interaction principles incorporated into the MMSB. Thirteen of the 18 students interviewed said they found this method of interaction to be very intuitive and easy to learn. Specifically, students indicated that the ability to physically move media to areas containing tools for a particular task helped them to discover how to apply those tools to the media they had selected. Several students also indicated that the consistency of the drag-and-drop interaction principles facilitated the MMSB learning process by providing them with an "assumed" method of interaction when they encountered new or unfamiliar functionality.

None of the student participants indicated any difficulty learning how to use the hierarchical file browser, supporting the assumption that users of the MMSB will be familiar with this GUI element. Two students, however, indicated they did not immediately realize that the MMSB allowed them to drag items from the file list onto a media table. Both of these students instead tried at first to double-click list items to get them onto a media table.

When asked about the MMSB's media tables and media box features, all of the students indicated that they were exceptionally intuitive and required little or no learning curve. Eleven of the students, however, did not discover all of the functionality of the media tables and media boxes without a degree of guidance. The most commonly undiscovered of these features was the momentum exhibited by media boxes (the ability to slide media boxes around a media table). Other features that were independently undiscovered by more than two students included the ability to scale and rotate a media box, the ability to create new media tables, and the ability to name a media table.

Students also indicated very few problems learning how to edit a media file's metadata. When asked about this, many students cited the MMSB's similarity to a web form in explaining its familiarity and intuitiveness. Ten students, however, described having difficulty learning how to create and edit multilingual subtitles within video and audio files' metadata.

Students expressed very little difficulty in learning how to create a multimedia presentation. After inquiring about this, it was found that many students were already familiar with the MMSB's multimedia presentation editing interface from prior experiences using other, functionally similar MPAs (of these MPAs, Sound Slides, Final Cut Pro, and Adobe Premiere were the most commonly identified). Because the potential users of the MMSB may or may not have experience using other MPAs, however, this feedback is less applicable as an indicator of the general intuitiveness of the MMSB's presentation creation functionality.

Overall the feedback gathered from students about their learning experiences with the MMSB was very positive. These preliminary results seem to indicate a general intuitiveness exhibited by the MMSB, which is essential in catering to a broad user group. From these results, several areas of functionality have been identified for improvement, however. These include improving the intuitiveness of the subtitling tools, making several media table and media box functions more obvious to the user, and incorporating other standard interaction principles to access existing functionality (such as allowing for double-clicking on media in the media file list to open it on a media table).

Effectiveness and Efficiency of the MMSB

After students became comfortable using the MMSB, their feedback shifted to focus more on the efficiency and effectiveness of the MMSB. And, like their experiences learning how to use the MMSB, the students seemed to be pleased with the MMSB in this area, as well. The drag-and-drop principles that are so prevalent throughout the MMSB were identified by most students as an effective and efficient interactive method. Students especially appreciated the ability to drag entire directories of media files from the file manager to other locations in the MMSB. Several students, however, indicated that dragging items was more difficult when using a laptop touch pad.

Students generally had no problems using the hierarchical file manager effectively. Some students suggested that thumbnail images of each media file (excluding audio files) would be more helpful than providing users with media-specific icons for the files in the file manager, though most students preferred the icons (many of whom cited the potential for graphical ambiguity among differing media types, such as photo and video files). Overall, students indicated that the hierarchical file browser was a simple and effective method for managing the MMSB's media files.

The MMSB's system for media metadata management was also well received by the students. Nine students particularly appreciated the ability to drop multiple files into a metadata editor, allowing for the rapid editing of several files' metadata. One aspect of this system that was identified by some students as sometimes ineffective, however, was the subtitling tool. These students found some elements of the subtitling tool extraneous or awkward. Many students indicated a desire for a subtitling tool that would use spatial elements to indicate the temporal data of a media file's subtitles – similar to the

functionality of the multimedia presentation timeline. Besides from this fairly consistent complaint, however, students described the overall metadata editing system of the MMSB as being efficient and effective.

The multimedia presentation system of the MMSB was generally described as being only moderately effective. When asked to elaborate on this, many students found it to be lacking some of the advanced editing features offered by some of the more complex MPAs, such as Final Cut Pro and Adobe Premiere. The students who identified these potential shortcomings, however, all had fairly extensive experience using these other MPAs. The six students who described the MMSB's multimedia presentation editor as being very efficient and/or effective all had little or no experience using the other complex MPAs. These results mitigate the impact of the feedback from the experienced MPA users. Because the MMSB seeks to accommodate users with less experience using other MPAs, it exhibits an inherent necessity for a degree of interface simplicity, rather than an extensive feature set. Overall, however, the basic interaction principles and current features incorporated into the MMSB's multimedia presentation editor, were described as being very intuitive and efficient by both novel and experience MPA users (specifically, these included the spatial representation of temporal data, the ability to add multiple files to a presentation at once, the method for adding an audio track to a presentation, and the insertion method for adding media into a presentation).

Overall, as they did with learning about the MMSB, students expressed an overall satisfaction with the efficiency and effectiveness of the MMSB. Feedback from students varied fairly significantly based on their prior experience using MPAs. Students with more experience using complex and feature-rich MPAs, generally had more suggestions

for improving the MMSB. Students with less experience using other MPAs or with experience using the less extensive MPAs (which accounted for a majority of the students in the class), were very pleased with the effectiveness and efficiency of the MMSB.

MMSB Functionality

Throughout the initial testing of the MMSB, students submitted many suggestions for additional functionality. These functions varied in their appropriateness for the MMSB and its goals, and would require more extensive testing in order to determine their implementation value. A list of the more popular of these functions along with the number of people who suggested each function is shown below.

Suggested Feature/Functionality	Times Suggested
graphical, timeline-based subtitles metadata editor	6
select multiple media boxes and media files from file list	6
keyboard shortcuts for various functionality	5
add transition support to presentation builder	5
add metadata to multimedia presentations	4
reorder media table tabs	3
media and metadata administrative approval system	3
save and load user-specific preferences	3
double-click on files to open them in media file manager	3
advanced options for MMSP in gallery mode (search, etc)	2
add search feature to file manager	2
multiple track support in media presentation editor	2

Implications for Future Testing

The information gathered during this week of testing was intended to produce a preliminary analysis of the MMSB and its overall usability and effectiveness. In order to more accurately assess these data, however, further testing is required. Future studies would need to be more structured and rigorous than the testing described in this paper. However, the results from this initial testing provide some direction for studies examining the MMSB in the future. For example, a potentially valuable study may examine the overall satisfaction and usability of the MMSB among users with varying degrees of media editing and MPA experience. This study would essentially compare and contrast the opinions of MMSB users who have varying levels of experience using various other MPAs. Another study might assess the usability of the MMSB using more quantitative methods of information gathering, such as eye tracking and speak-aloud protocol. Yet another viable study would be one that gathers qualitative data about the MMSB (similar to the study described in this paper), but from a different user group than the one used for the study described in this paper.

There is still a necessity for further testing before it can be said that the MMSB has successfully achieved its goals. The preliminary testing described in this paper is meant to be a starting point for these future studies, which may indicate more accurately the true success of the MMSB.

Lessons Learned

The planning, development, documentation, and evaluation of the MMSB and MMSP were all very informative processes. I learned quickly that the scope of the project that I chose was too big relative to the time frame allowed for its completion. The MMSB and MMSP together, comprise 117 classes and about 60,000 lines of code. These projects probably should have been completed over the course of a year or more. I realize now that this project would have progressed more efficiently if the MMSB and MMSP were completed before the fall semester began and this project was structured as more of a formal study on their usability and functional effectiveness. This proposed project structure would have also allowed me to thoroughly research existing literature and gather potential user input well before making my design decisions. The actual structure of this project forced me to research my design decisions as I was developing the application – often forcing me to make last minute changes to my code.

Despite the changes I would make to the scope and structure of this project (if I could do it over), however, I feel that the MMSB and MMSP turned out to be very effective and robust applications. The feedback that I gathered from the JOMC 491 class was very positive overall, and the additional feedback that I have gotten from other sources is even more positive. I am anxious to continue to gather more information on the usability and functionality of the MMSB and MMSP in order to continually improve upon its design and push the limits of its intuitiveness.

Notes

Agarawala, Anand and Ravin Balakrishnan. “Keepin’ It Real: Pushing the Desktop Metaphor with Physics, Piles and the Pen”. *Proceedings of the SIGCHI conference on Human factors in computing systems* (7-11 May 1995): 1283-1292.

Bobrowicz, A. and Christie, B. Usability and emergent properties of multimedia creations. Europrix Scholars Conference 2003: Information Society and Digital Media For All, Tampere, Finland. 13–14 Nov. 2003.

Mander, R., Salomon, G., and Wong, Y. (1992). “A ‘pile’ metaphor for supporting casual organization of information”. *Proceedings of the SIGCHI conference on Human factors in computing systems*. (3-7 May 1992): 260-269.

Market Share for Browsers, Operating Systems and Search Engines. 1 Nov. 2006. Net Applications. 1 Nov. 2006 <http://marketshare.hitslink.com/report.aspx?qprid=2>.

Norman, Donald. *The Psychology of Everyday Things*. New York: Basic Books, Inc., 1988.

Appendices

Appendix A

Media Types

photo	Audio	text	video

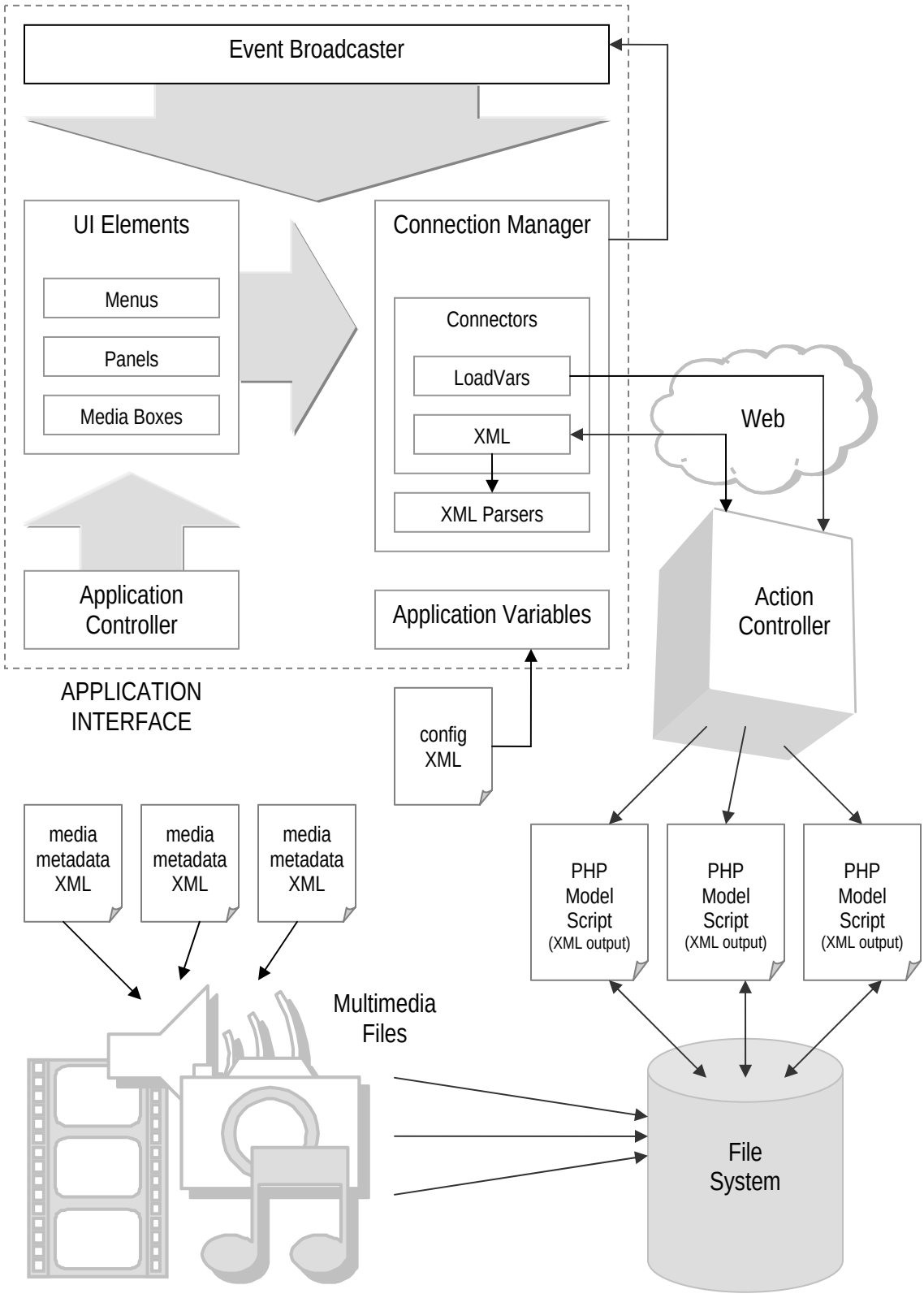
Levels of Complexity (from most to least complex)

very complex	complex	moderate	simple	very simple

MPA/SMPA Name	Media Accommodated	Complexity
Able Photo Slide Show	photo, text	simple
Acid Pro	audio	moderate
Adobe Audition	audio	complex
Adobe Flash	photo, audio, video, text	complex
Adobe Premiere	photo, audio, video, text	very complex
Amara Flash Slideshow Software	photo, audio	very simple
EaseFlash Slide Show Generator	photo, audio, text	moderate
Final Cut Pro	photo, audio, video, text	very complex
Garage Band	audio	simple
I-Movie	photo, audio, video, text	simple
MMSB and MMSP	photo, audio, video, text	simple
OneTrueMedia	photo, audio, video, text	moderate
Picasa	photo, text	moderate
Pro Show Gold	photo, audio, video, text	complex
Pro Tools	audio	complex
Slide Show Pilot	photo	moderate
Slide Show Pro	photo, audio, text	moderate
Slide Show To Go	photo, text, audio	moderate
Sound Slides	photo, audio, text	very simple
VideoMach	video, audio, text	complex
Windows Movie Maker	photo, video, text	simple
Wondershare Slide Show Builder	photo, audio, text	simple

Appendix B

MMSB Application Architecture



Appendix C

Informational Handout Given to JOMC 491 Students

Creating and Viewing Your Stories

In this class you will be creating and viewing your stories using the newly developed Multimedia Story Builder and Multimedia Story Player. In addition to using the applications in this capacity, you will also be asked to help in evaluating their usability, effectiveness, and functional efficiency. As such, it is important that you take note of any good or bad experiences you have while using the applications or any suggestions you have for their improvement. During the classes held on November 7th and November 10th, you will each be informally interviewed about your experiences using the Multimedia Story Builder. Additionally, you are encouraged to send any questions, comments, or functionality requests to tjackson@email.unc.edu. Feel free to send as many emails as you wish to this address concerning this evaluation. Thank you for your participation.

Appendix D

General Interview Script for Preliminary Testing (November 7, 2006)

1) What were your first impressions of the MMSB, its interface, and its interaction principles? Please provide specific examples of what affected this initial impression – whether for good or for bad.

2) What MMSB functionality, if any, have you found to particularly intuitive, or easy to figure out? What do you think made these functions easy to learn?

3) What MMSB functionality, if any, have you found to be particularly unintuitive, or difficult to figure out? What do you think made these functions difficult to learn?

4) Based on your experience using the MMSB so far, please describe your overall opinion of the application and your level of satisfaction in using it to create a multimedia presentation. Please elaborate on any aspects of the MMSB that affect your opinion more than others.

General Interview Script for Preliminary Testing (November 9, 2006)

1) Which tasks, if any, do you find easy to perform using the MMSB? How so? Are there any improvements to the MMSB that you think might make these tasks easier?

2) Which tasks, if any, do you find tedious or difficult to perform using the MMSB? Are there any improvements to the MMSB that you think might make these tasks easier?

3) What functionality, if any, do you think the MMSB is lacking in facilitating the creation of a multimedia presentation?

4) Is there any function of the MMSB that you feel you do not understand? Please explain.

5) Based on your experience using the MMSB so far, please describe your overall opinion of the application and your level of satisfaction in using it to create a multimedia presentation. Please elaborate on any aspects of the MMSB that affect your opinion more than others.

Works Referenced

Bauer, D. “A multiscale workspace for managing and exploring personal digital libraries”. ACMUIST ’03: Doctoral Symposium (November 2003).

Bauer, D., Fastrez, P., & Hollan, J. “Spatial Tools for Managing Personal Information Collections”. *Proceedings of the 38th Hawaii International Conference on System Sciences* 4.4 (2005): 104b.

Bauer, D., Fastrez, P., & Hollan, J. “Computationally-Enriched ‘Piles’ for Managing Digital Photo Collections”. *Proceedings of the 2004 IEEE Symposium on Visual Languages and Human-Centric Computing* (2004): 193-195.

Gonzalez, C. “Does animation in user interfaces improve decision making?” *Proceedings of the SIGCHI conference on Human factors in computing systems* (1996): 27-34.

Greenberg, S. and C. Fitchett. “Phidgets: easy development of physical interfaces through physical widgets”. *Proceedings of the 14th annual ACM symposium on User interface software and technology* (2001): 209-218.

K. Rodden and K. Wood. “How do people manage their digital photographs?” *Proceedings of ACM CHI’03* (April 2003): 409–416.

Lansdale, M. “The psychology of personal information management”. *Applied Ergonomics* 55 (1988): 55-66.

Shipman, F. M., Marshall, C. C., & Moran, T. P., “Finding and Using Implicit Structure in Human-Organized Spatial Layouts of Information”. *Human Factors in Computing Systems* (1995): 346-353.